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| APPLICATION NO | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO |
|----------------|-------------|----------------------|---------------------|-----------------|
| 10 005,355 | 12 07 2001 | Jiro Yugami | 520.40885X00 | 7873 |

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EXAMINER

GEYER, SCOTT B

ART UNIT PAPER NUMBER

2829

DATE MAILED: 04 23 2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|-----------------|---------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/005.355 | YUGAMI ET AL. |
| | Examiner | Art Unit |
| | Scott B. Geyer | 2829 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 14 February 2003.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 6 and 8-20 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-5 and 7 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 07 December 2001 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

| | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Claims 6 and 8-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected invention(s), there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

3. The references cited within the information disclosure statement, entered as paper no. 3, have been considered.

Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "109" has been used to designate both "photoresist" and "metal film" in figure 2C. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

5. The disclosure is objected to because of the following informalities:
Page 14, line 6: change "out" to - - our - -.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 7 recites the limitation "metal" in line 2. There is insufficient antecedent basis for this limitation in the claim. Claim 1 merely recites an insulating film that has a dielectric constant higher than that of silicon dioxide and does not make any mention of the insulating film comprised of *metal*. For purposes of examination, claim 7 will be interpreted as the source and drain region not containing the *material* contained in the insulating film.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1, 2, 3, 5 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Ono (6,495,890 B1).

10. As to ***claim 1***, Ono teaches a field effect transistor (FET), made by the steps as shown for example in figures 5A through 5G. In figure 5G, the FET has a

semiconductor substrate 101, a gate insulating film 111 on the substrate and a gate electrode 106 on the gate insulating film. The gate insulating film is comprised of titanium oxide (TiO_2) as disclosed in column 6, lines 15-18, which has a higher dielectric constant than silicon dioxide. As disclosed further in column 6 (which corresponds to figures 5A-5G), the gate insulating film 111 is etched back such that the end portions of the gate insulating film are positioned inwardly from the respective end portions of the source/drain regions 107, which can be clearly seen in figure 5F. The end portions of the gate insulating film are also positioned such that the gate electrode 106 overlaps the source/drain regions 107 in plan configuration.

11. As to **claim 2**, Ono teaches a field effect transistor (FET), made by the steps as shown for example in figures 5A through 5G. In figure 5G, the FET has a semiconductor substrate 101, a gate insulating film 111 on the substrate and a gate electrode 106 on the gate insulating film. The gate insulating film is comprised of titanium oxide (TiO_2) as disclosed in column 6, lines 15-18, which has a higher dielectric constant than silicon dioxide. As disclosed further in column 6 (which corresponds to figures 5A-5G), the gate insulating film 111 is etched back such that the end portions of the gate insulating film are positioned inwardly from the respective end portions of the source/drain regions 107, which can be clearly seen in figure 5F. The gate insulating film is also positioned such that the source/drain regions 107 extend underneath a portion of the gate insulating film 111, which is also clearly depicted in figure 5F.

12. As to **claim 3**, Ono teaches an insulating film 109 provided laterally of the gate insulating film 111 and also on the semiconductor substrate, which is clearly shown

in figure 5G. The insulating film 109 is a silicon oxide film (see column 6, lines 33-40), which has a lower dielectric constant than titanium oxide, which is the material of the gate insulating film 111.

13. As to **claim 5**, Ono teaches the gate insulating film 111 made of titanium oxide (see column 6, lines 15 et seq.).

14. As to **claim 7**, Ono teaches a boron implantation (see figure 5B) which defines channel region 104, prior to deposition of the insulating film 111. In subsequent steps, the channel region 104 will become the source/drain regions 107. Ono further teaches the insulating film 111 comprised of titanium oxide (TiO_2). Due to the boron implantation step being performed prior to the deposition of the titanium oxide film, the titanium oxide will not be contained in the source/drain regions.

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ono (6,495,890 B1) in view of Abrokwah et al. (5,514,891).

17. As to **claim 4**, Ono teaches undercutting of the gate insulating film 111, as shown in figure 5F so that the gate insulating film is positioned inwardly of the source/drain regions. Ono does not teach undercutting of the gate electrode by 15nm to 25 nm. However, Abrokwah et al. teach a field effect transistor, specifically a

HIGFET, as shown in figure 2, wherein the insulator 16 is undercut to form a T-shaped gate structure. Abrokwah et al. further define the undercutting by a distance 22 which is 50 to 1000 Angstroms (5-100 nm). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the undercutting of Ono with a distance of 5 to 100 nm as taught by Abrokwah et al. to provide a gate structure which has reduced gate leakage current.

Conclusion

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott B. Geyer whose telephone number is (703) 306-5866. The examiner can normally be reached on weekdays, between 10:00am - 6:30pm. The examiner may also be reached via e-mail: scott.geyer@uspto.gov

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo can be reached on (703) 308-1233. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SCOTT GEYER
PATENT EXAMINER

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SBG
April 15, 2003